

CURRENTLY PENDING CLAIMS

Please amend the claims as follows:

1.-8. (Cancelled)

9. (Currently Amended) A method for chemical mechanical polishing of tungsten comprising:

providing a semiconductor substrate comprising on one face tungsten and a dielectric material;

providing a chemical mechanical polishing composition comprising between about 0.5% and about 10% periodic acid, between about 0.1% and about 10% of a secondary oxidizer, and a pH adjusting compound to adjust the pH of the composition, wherein the pH of the composition is from about 6 to about 9;

movably contacting the substrate face with a pad exerting a between about 0.1 and about 9 psi pressure on the substrate ~~and with the composition~~ under conditions that tungsten is removed both at a rate equal to or greater than 500 Angstroms/minute and at a rate different than the removal of the dielectric material.

10. (Currently Amended) A method for chemical mechanical polishing of tungsten comprising:

providing a semiconductor substrate comprising on one face tungsten and a dielectric material;

providing a chemical mechanical polishing composition comprising between about 0.5% and about 10% periodic acid, between about 0.1% and about 10% of malonic acid, and a pH adjusting compound to adjust the pH of the composition, wherein the pH of the composition is between about ~~4 to about 12~~ 6 to about 9; and

movably contacting the substrate face with a pad exerting between about 0.1 and about 9 psi pressure on the substrate and with the composition under conditions that tungsten is removed at a rate different than the removal of the dielectric material.

11. (Original) The process of claim 9 wherein the chemical mechanical polishing composition comprises at least one of potassium iodate, potassium periodate, or lithium periodate.

12. (Original) The process of claim 9 wherein the chemical mechanical composition comprises ammonium persulfate, peracetic acid, oxalic acid, NH_4HF_2 , or a mixture thereof.

13. (Previously Presented) The process of claim 9 wherein the secondary oxidizer comprises a perborate.

14. (Original) The process of claim 9 wherein the chemical mechanical polishing composition additionally comprises an organic acid selected from the group consisting of gluconic, malonic acid, lactic acid, succinic acid, tartaric acid, citric acid, oxalic acid, or salts thereof.

15. (Previously Presented) The process of claim 9 further comprising a second polishing operation comprising the steps of:

providing a second chemical mechanical polishing composition comprising an oxidizer, a pH adjusting compound to adjust the pH of the second composition, wherein the pH of the composition is between about 3 to about 12; and

movably contacting the substrate face with a pad exerting between about 0.1 and about 9 psi pressure on the substrate and with the second composition under conditions that tungsten is removed at a rate different than the removal of the dielectric material.

16. (Previously Presented) The process of claim 15 wherein the second chemical mechanical polishing composition comprises between about 0.5% and about 10% periodic acid and a pH adjusting compound to adjust the pH of the composition, wherein the pH of the second composition is between about 3 to about 12.

17.-47. (Cancelled)

48. (Previously Presented) The method of claim 9 wherein the secondary oxidizer comprises potassium peroxymonosulfate.

49. (Previously Presented) The method of claim 9 wherein the secondary oxidizer comprises potassium iodate.

50. (Previously Presented) The method of claim 9 wherein the secondary oxidizer comprises potassium periodate.

51. (Previously Presented) The method of claim 9 wherein the secondary oxidizer comprises lithium periodate.

52. (Previously Presented) The method of claim 9 wherein the secondary oxidizer comprises ammonium persulfate.

53. (Previously Presented) The method of claim 9 wherein the secondary oxidizer comprises peracetic acid.

54. (Previously Presented) The method of claim 9 wherein the secondary oxidizer comprises NH_4HF_2 .

55. (Previously Presented) The method of claim 9 wherein the secondary oxidizer comprises a peroxide hydrate.

56. (Previously Presented) The method of claim 9 wherein the secondary oxidizer comprises a urea hydrogen peroxide complex.

57. (Previously Presented) A method for chemical mechanical polishing of tungsten comprising:

providing a semiconductor substrate comprising on one face tungsten and a dielectric material;

providing a chemical mechanical polishing composition comprising between about 0.5% and about 10% periodic acid, between about 0.1% and about 10 % of imidazole or malonamide, and a pH adjusting compound to adjust the pH of the composition, wherein the pH of the composition is between about 4 to about 12; and

movably contacting the substrate face with a pad exerting between about 0.1 and about 9 psi pressure on the substrate and with the composition under conditions that tungsten is removed at a rate different than the removal of the dielectric material.

58. (Currently Amended) A method for chemical mechanical polishing of tungsten comprising:

providing a semiconductor substrate comprising on one face tungsten and a dielectric material;

providing a chemical mechanical polishing composition comprising between about 0.5% and about 10% periodic acid, between about 0.1% and about 10 % of oxalic acid, and a pH adjusting compound to adjust the pH of the composition, wherein the pH of the composition is between about ~~4 to about 12~~ 6 to about 9; and

movably contacting the substrate face with a pad exerting between about 0.1 and about 9 psi pressure on the substrate and with the composition under conditions that tungsten is removed at a rate different than the removal of the dielectric material.

59. (Previously Presented) The process of claim 10 wherein the chemical mechanical polishing composition additionally comprises an organic acid selected from the group consisting of gluconic acid, lactic acid, succinic acid, tartaric acid, citric acid, oxalic acid, or salts thereof.

60. (Previously Presented) The process of claim 10 wherein the chemical mechanical polishing composition additionally comprises an abrasive.

61. (Previously Presented) The process of claim 10 wherein the chemical mechanical polishing composition additionally comprises imidazole or malonamide.

62. (Previously Presented) The process of claim 10 further comprising a second polishing operation comprising the steps of:

providing a second chemical mechanical polishing composition comprising an oxidizer, a pH adjusting compound to adjust the pH of the composition, and optionally an abrasive, wherein the pH of the composition is between about 3 to about 12;

movably contacting the substrate face with a pad exerting between about 0.1 and about 9 psi pressure on the substrate and with the second composition under conditions that tungsten is removed at a rate different than the removal of the dielectric material.

63. (Previously Presented) The process of claim 62 wherein the second chemical mechanical polishing composition comprises between about 0.5% and about 10% periodic acid and a pH adjusting compound to adjust the pH of the composition, wherein the pH of the second composition is between about 3 to about 12.

64. (Previously Presented) The method of claim 9, wherein the pH of the composition is from 7 to 9.

65. (Previously Presented) The method of claim 10, wherein the pH of the composition is from 6 to 9.

66. (Previously Presented) The method of claim 10, wherein the pH of the composition is from 7 to 9.